

## Advanced Computer Networks

### Take-Home Exam October 15, 2020

Name (Do NOT write your student ID number!): \_\_\_\_\_

1. Make sure you have all 6 questions (100 points total).
2. Closed book, one sheet, two sides of notes allowed, no access to the Internet.
3. No copying, collaboration, or discussing the exam.
4. Either write by hand and scan – or type up your answers. Submit to UNM Learn.
5. Exam Duration: 24 hours (due by 2PM on Friday October 16, 2020).

1.(20) \_\_\_\_\_

2.(20) \_\_\_\_\_

3.(15) \_\_\_\_\_

4.(15) \_\_\_\_\_

5.(15) \_\_\_\_\_

6.(15) \_\_\_\_\_

Total (100): \_\_\_\_\_

1. (20%) The Chief Information Officer at UNM wants to install a new class live-streaming system on campus for the students to attend classes remotely on their laptops. As an excellent communications engineer, you are asked to propose a network architecture for this streaming system. Would you propose a circuit-switched, a packet-switched or a virtual circuit-switched solution? Summarize the pros and cons of each solution, and why you pick the one you propose. Show your work and use *engineering* arguments, e.g., cost, quality of service.

2. (20%) Amy and John are part of a wireless local area network in a mountainous area of New Mexico. They live in the same municipality but at some distance apart, and a large hill is obstructing their ability to receive each other's signal directly. However, their WLAN still operates in infrastructure mode, via a centrally located base station/access point, which they both can "hear". Describe TWO different architectures/approaches that this WLAN could be based on. For each of the two architectures, sketch the main principles they would be based on, and how the "hidden terminal" problem would be overcome. Explain your answer, including arguments about efficiency, throughput and cost.
3. (15%) Alice's laptop uses a standard TCP stack implemented in hardware that cannot be re-programmed or altered by the user. Alice needs to use her laptop to access the Web over a WAN while commuting on a train each day. Which mobility solution would you select between "split connection TCP" and "TCP aware wireless link" (e.g., "snoop TCP")? Explain your answer, show your work.
4. (15%) What are the most important differences between 3G and 4G cellular systems? Be concise but also explain your answer carefully.

5. (15%) Suppose that the great city of Albuquerque decides to become the smartest city in the USA by implementing ubiquitous high-speed wireless access (at least 20Mbps) accessible everywhere in the city: by people connecting to the Internet; by smart vehicles coordinating their routes; by a smart energy grid coordinating renewable energy flow and storage; and by smart public safety and crowd security systems. Would you recommend using WiFi WLANs (e.g., from lamp posts in the street) or cellular 4G LTE? Justify your arguments carefully using reasonable assumptions, economic aspects and other qualitative and quantitative factors.
  
6. (15%) Suppose you are the Chief Engineer for Apple's iPhone 13. One of your talented Computer Engineers, a UNM graduate, comes to you with a bright idea: in the place of making the phone out of *open, standard, layer-based* hardware and software, instead work on a new super-optimized but "closed" architecture, with cross-layer shortcuts, and violations of layering and standards, that could save at least \$100 per device manufactured to order at the Apple factory, and also \$1 operating costs for each day that the phone is operated. What would you do? And what would be the rational basis for your response? State your assumptions and be precise and quantitative.